

On some undescribed Acari of the genus *Glyciphagus*, found in Moles' Nests. By ALBERT D. MICHAEL, F.L.S., F.Z.S.

[Read 18th February, 1886.]

(PLATES XXXIV. & XXXV.)

FOR some years past I have been, from time to time, investigating the life-histories of some Acarine parasites of the Mole, and in the Christmas of 1885, being for a short time in one of our midland counties, I continued the inquiry. There were, however, a few points which I could not succeed in elucidating, and it struck me that I might possibly obtain the information I desired, if, instead of continuing to search the Moles themselves, I examined their nests.

I do not, of course, propose to give any description of so well-known a structure as the "fortress of the mole," but I may be excused for referring for a moment to the nature of the actual nest in the twelve examples which I dug up and examined. Inside the domed earthen chamber, and about a foot below the surface of the ground, was the nest—an almost globular structure about six inches in diameter, composed of dried grass and dead leaves; the former usually forming the exterior, and the latter the interior of the ball, although the two classes of material were not strictly kept separate. In the larger number of the nests I found but little; in three or four, however, which, when I dug them up, I had remarked as appearing to be fresh nests, the case was very different.

On opening the first of these nests, and putting a portion under a microscope with a low amplification, I was surprised to see before me several Acari quite unknown to me, and very remarkable, which I also found in the other fresh nests, so that my search, whether it serves the original purpose or not, has not been fruitless. Amongst them were two closely-allied, but very striking species, which I believe to be new to science, and it is with these two species that I propose to deal in the present paper. They were both found chiefly between the leaves in the interior of the nest, and an examination showed that they belonged to the genus *Glyciphagus*, although presenting some rather exceptional characters. They were not uncommon, and I was therefore able to secure sufficient material to give a fairly complete account of them in all stages.

The genus *Glyciphagus* was instituted by Hering\* in 1835, for an *Acarus* which he found feeding on dried fruits. It is to be feared that many of the species which have been added to it by subsequent authors do not properly belong to it. In the year 1867, however, MM. Fumouze and Robin † took considerable trouble to define the genus, and the leading characters of that definition may probably be fairly summarized (somewhat as by Andrew Murray ‡) as Tyroglyphidæ with long tarsi, a rough (granular) skin, with feathered, pectinated or palmate hairs; and the females whereof are provided with a short, tubular projection in the median line of the hind margin, which Murray calls "an anal button."

In 1868, Robin § found it necessary to modify this definition, so far as the plumose condition of the hairs was concerned, in order to include a species discovered and called by him *Glyciphagus hericius*, which had simple setiform hairs.

Fumouze and Robin divided the genus into two parts: the second division, which they call "*Glyciphagi* with plumose or palmate hairs," has the skin more strongly granular, the abdomen broader and flatter, the tarsi shorter, and the hairs shorter, but otherwise much more developed than in the first division. The *Acari* which I am about to describe clearly belong to this second division; but in order to admit them, it is necessary to modify the subgenus as Robin modified the genus, for the hairs in this instance are not developed into plumes or leaf-like structures, but into strong, thick spikes.

Fumouze and Robin's subgenus contained only two species, viz. *G. plumiger* and *G. palmifer*; and it is not strange that other curious species should be added to the division which contains these very beautiful and remarkable creatures.

I ventured early in 1879 to point out that the anal button, or tubular projection, which acarologists then apparently considered as a useless ornament, was really the bursa copulatrix,

\* "Die Kräzmilben der Thiere und einige verwandte Arten." Nov. Act. Acad. Leop. t. xviii. pt. xi. p. 619.

† "Mém. anatomique et zoologique sur les Acariens des genres *Cheyletus*, *Glyciphagus* et *Tyroglyphus*." Journ. de l'Anat. et de la Physiol. (Robin), t. iv. (1867), p. 568.

‡ Economic Entomology, London, 1876, p. 276.

§ "Recherches sur une espèce nouvelle de Sarcoptides du genre *Glyciphage*." Journ. de l'Anat. et de la Physiol. (Robin), t. v. p. 604.

which was post-anal, and far distant from the organ called the vulva, which was used only for the deposition of ova. I believe that the correctness of this view is now generally admitted, not only with regard to the genus *Glyciphagus*, but, as far as the position of the bursa and organs of oviposition respectively are concerned, in the Tyroglyphidæ generally. If this view were not admitted the present species would give an excellent opportunity of establishing it, as will be seen by the remarks which will be found below on the species which I propose to call *G. dispar*.

At the end of this paper I have given the usual detailed description of each species, but I will here call attention to what seems to me to be the more interesting features connected with them.

What strikes the observer first is naturally the singular general appearance of the creatures, produced by the great size of the abdomen as compared with the cephalothorax, by the broad, flat form and almost horseshoe-shaped outline of the latter, and specially by the lateral margins (and in some instances the other margins) being raised and cut up into large, irregular, rough, bifid or trifid lobes; most of these lobes bearing a single extremely large spine or spike, either curved or straight, of clear, hard chitin, which give the animal a very strange, and, when freshly emerged and the skin is like frosted silver, a very beautiful appearance. A little observation, however, discloses something more worthy of attention by the biologist than the bizarre appearance, which is this. In the genus *Glyciphagus* it is usual to find a well-marked distinction between the sexes, the male being usually considerably smaller than the female, often not above two thirds of the length, and rather less than the proportional breadth; the hairs are less plumose or palmate, and the posterior projection is of course absent. These differences, although very apparent, are after all comparatively slight modifications, not greater than exist between the sexes in other genera of the same family, and not such as to cause the least surprise at the creatures belonging to the same species. In the larger of the two Acari now being described, and which I propose to call *G. platygaster*, the ordinary rule of the genus in this respect is well carried out. The sexes show considerable differences, but are alike in general character, and would be taken at once for the male and female of the same species. The male is the smaller, in about the customary proportion, and has the lobes and spikes round the hind margin

as well as the lateral margins; while the hind margin of the female in the neighbourhood of the bursa is straight and spikeless. The object of this is of course manifest. There are considerable differences in the epimera and ventral surface, &c., but these differences are, after all, comparatively slight modifications. When we come to deal with the second species, *G. dispar*, we find that the female is very like that of *G. platygaster*; it is very much smaller, and presents such well-marked specific differences that no naturalist, however averse to species-making, would think of considering them as identical; but, on the other hand, every one would admit that they were closely-allied species, and this whether they regarded general appearance or minuter structure. On turning to the male, however, the case is entirely different. It is utterly unlike both the male of *G. platygaster* and its own female; and I venture to think that no arachnologist who had not found them *in coitu*, would have supposed the male and female to belong to the same species or genus, probably hardly to the same family or subfamily. The male is not above half the length of the female, and, contrary to the ordinary rule in the genus, its breadth is rather greater in proportion to its length than in the female. The abdomen is broadest in front and narrowest behind, exactly contrary to what occurs in the female; the raised edge, the bifid or trifid lobes, the great spines or spikes—all of which characteristics form the principal features both of its female and of both sexes of the larger species—are entirely absent. The great spines are replaced by a few minute points, and there are not any hairs on the body; again, the legs, instead of being long and slender, as in the female, are short and thick; the two hind pairs are entirely hidden beneath the abdomen: and indeed the whole creature seems quite different. It does appear to me very strange in a genus where the males and females generally have only moderately marked differences, that in two species, the females of which are so closely allied, one should have a male resembling the female as nearly as is usual in the genus, and the other should have a male so extremely dissimilar. When we look at the fact that the two species are found in the same place, and apparently under precisely the same conditions in all respects, the question arises what can have been the cause of this remarkable variation, and to that question I confess I cannot at present offer any satisfactory explanation; it is difficult to understand how survival of the fittest can have produced it.

I have said that I should not have supposed the creatures to be different sexes of the same animal had I not found them *in coitu*; but this I did, not in one case only, but in very numerous instances, so that there cannot be any doubt about it.

This brings me to another branch of my subject, viz. the satisfactory proof which this species affords that the posterior projection of the females is the bursa copulatrix. In most species of this genus and its close allies, and in the *Dermaleichi*, the coitus lasts a long time, as in the Lepidoptera, with this difference between the Acari and the Insects, that whereas in the latter the pair remain mostly stationary, in the former they keep in almost constant motion; the female, which is the larger and more powerful creature, dragging its companion. In the present species, *G. dispar*, the disproportion in the size of the sexes is so great that the female does not drag, but carries the male, the anterior half of the male lying on the dorsal surface of the hind part of the abdomen of the female, which is clasped by the two front pairs of legs of the male, whose two hind pairs, usually directed backward, are now bent directly forward on the ventral surface of the female. Her abdomen is thus clasped by all the legs, and so firm is this grasp that not only may the pair be removed to the microscope and placed under a cover glass, and both the dorsal and ventral surface examined without its becoming relaxed, but it is even possible to make permanent microscopical preparations of the two *in situ*—one of these preparations being shown on the occasion of reading this paper. The drawing of the pair in position (Pl. XXXV. fig. 8) was drawn from the life with the assistance of such a preparation. This peculiar position of the hind legs, the absence of hairs from the male, and the flatness of its underside, enable the position of the organs to be most clearly seen, and would alone settle the question of the bursa copulatrix if it were still in doubt. There is, however, an additional and interesting piece of evidence. It was pointed out by Haller, in a paper dated November 1879\*, that in *Tyroglyphus setiferus* the post-anal copulative opening of the female, which is in this case a mere pore, not a projection, led by a very short neck into an almost globular receptaculum seminis. This has lately been carefully worked out by Dr. Alfred Nalepa, in the

\* "Zur Kenntniss der Tyroglyphen und Verwandten" Zeitschr. f. wiss. Zool. xxxiv. Bd. p. 288.

cases of *Tyroglyphus longior* and *Tyroglyphus (Trichodactylus) anonymus*\*. In these cases also the duct between the bursa and the receptaculum is extremely short, indeed scarcely marked. In the present species, which belongs to a different genus, the duct is long and slender, as will be seen from Pl. XXXIV. fig. 14 *d*, which is drawn from an actual dissection, not from sections; the duct may however be clearly seen in the living creature when one has become acquainted with its position by dissection.

The construction of the articulation of the tarsal joint of the two hind pairs of legs of the male in both species is worthy of notice; it is evidently of use in giving great play to the joint for clasping purposes; it will be found in the descriptions of *G. platygaster*, and in fig. 9, Pl. XXXIV., and figs. 15, 16, Pl. XXXV. Lastly, a curious little matter is the existence of a singular hair (Pl. XXXIV. fig. 12), not above  $\frac{1}{1000}$  inch long, on the side of the body of the male, between the coxæ of the first and second legs; this minute hair is so branched as to resemble a tuft of fine Algæ; its size and position prevent it from being seen on the whole creature; I only discovered it on dissections of the exoskeleton. I am not sure whether it exists in the female. A somewhat similar hair, similarly placed, was discovered by Dr. Kramer on *Glyciphagus ornatus*†. Dr. Kramer says that the hair in his species stood before a minute opening; I did not see an opening in the present species, but it may exist.

It remains to be considered what is the connection between these *Glyciphagi* and the Mole, and this is far from an easy problem to solve. I have now been in the habit of examining fresh Moles for some years, whenever I could get them, and have examined a large number. I caught twelve Moles this Christmas, in the same fields from which I dug up the nests as above mentioned, and at the same time; and yet I have never seen a sign of one of these *Glyciphagi* in any stage upon a Mole.

On the other hand, in all my searches for Acari in moss, grass, and leaves, extending over many years, and continued at the time and place of obtaining the above Moles' nests, I have never seen a specimen of either of the present species; nor were there any in those nests, which from external appearances I had supposed to be old and abandoned. This subject is one

\* "Die Anatomie der Tyroglyphen." Sitzsber. der k. Akad. der Wissensch. Wien, xc. Bd. 1 Abth. p. 197 (1884); *ibid.* xcii. Bd. 1 Abth. p. 116 (1885).

† "Ueber Milben." Zeitschr. für die gesammten Naturw., liv. Bd. (1881).

requiring further investigation, and at present I am not prepared to give an opinion on it.

GLYCIPHAGUS PLATYGASTER, n. sp. (Plate XXXIV., and Plate XXXV. figs. 1-5.)

	Female.	Male.
Average length, about.....	·76 mm.	·54 mm.
„ breadth, about .....	·65	·44
„ length of legs, 1st pair, about.....	·35	·32
„ „ 2nd „ .....	·32	·25
„ „ 3rd „ .....	·38	·28
„ „ 4th „ .....	·46	·41

**Colour**, when just emerged, pure white, afterwards cream-white to parchment-colour, or with a pinkish shade; the male sometimes a little darker; legs and rostrum light pinkish-brown; all the colours opaque.

**Texture** of the body rough and granulated, like shagreen. The male is the rougher. The result of this is that all the edges of the body appear to be, and actually are, covered with a thickly-set series of irregular projecting dots, or short blunt points.

#### *Female.*

**Cephalothorax** small, short, and conical, with curved sides; less than one sixth of the total length of the creature, as seen from above. Rostrum or epistome, rather obtuse, forming a hood above the mandibles, which project, giving a pointed appearance. The two rostral hairs are thick, stiff, and strongly curved downward; further back (on the dorso-vertex) are two powerful spikes directed forward, springing from large papillæ placed near together and almost close to the anterior margin of the abdomen. Mandibles (fig. 7) large, short, tridentate. Maxillæ (so-called) (fig. 6, *mx*) plain, not dentate, and of clear colourless thin chitin. There is a well-marked chitinous skeleton supporting the labial parts and projecting inward, as indicated in fig. 6. Palpi three-jointed, lower joint anchylosed to labium (Plate XXXV. fig. 4). Lingula triangular, somewhat spoon-shaped, of clear membrane.

**Legs** very thin in proportion to the size of the creature, rather short; fourth pair passing the hind margin by rather more than half the length of the tarsus. The two front pairs spring from large, rounded, chitinous projections at the edge of the lower part of the cephalothorax, having rough chitinous knobs at their posterior angles; the third and fourth pairs are set well under

the body. The legs themselves diminish gradually in thickness from the proximal to the distal ends, and each is terminated by a very small single claw, furnished with a sucker or caruncle. The coxæ are short and rounded, the tarsi nearly as long as the three previous joints, which are not far from equal to one another in length. The tibiæ of the first three pairs of legs bear long, flexible, tactile hairs, which are present, but very small, in the fourth pair; where possibly they are useless in consequence of these legs being usually almost entirely beneath the abdomen. The other hairs on the legs are stiffer and more spine-like in character. They are as follows, viz.:—a pair on the third joint of each leg, those on the two front pairs of legs being opposite, and strongly curved downward and inward, and slightly serrated; a very strong, somewhat similarly curved spine springs from the underside of each tibia near its distal end; there are two or three short spines on the underside of each tarsus, and one, rather larger, on the upper side of that of the second pair.

**Abdomen** large, gradually increasing in width from the anterior until near the hind margin; the increase is, however, more rapid in the first third of the abdomen. The anterior and posterior margins are almost straight. The dorsal surface of the abdomen (notogaster) is considerably raised above the cephalothorax, and is almost flat in general level, but its lateral edges form bands which are depressed at their inner and slightly raised at their outer sides, and its anterior and posterior edges are somewhat depressed. From the inner edges of the bands the abdomen is slightly arched upward, but it forms a very low flat arch rising but little above the outer edge of the bands; the extent of the arching varies in different specimens and at different ages, and there are often vague irregular depressions in the surface. Along the outer edge of the lateral band, on each side of the abdomen, are ten singular projections, often having markings of darker colour at their bases; the first of these is at the angle of the anterior and the tenth at that of the hind margin. The first, third, and tenth are single and papillous; the second, fifth, and sixth single, but less projecting, and directed backward in a somewhat hooked form; the fourth and ninth have an approach to a bifid form, and the seventh and eighth are decidedly trifid. From each projection, except the second, fifth, and sixth, springs a large and powerful pointed spine more or less radial in position; those that spring from the first, third, fourth, and ninth projections



are decidedly, but not strongly, curved; the others are straighter. In the centre of the hind margin is the projecting "button" characteristic of the females of this genus, and which is really a bursa copulatrix; it is rather unusually long, and directed slightly upward. Down the back are two rows of fine strong spines, of which the first is directed forward and the others backward; the third of these is the longest and the fourth the shortest. There is also a very long spine between the third and fourth, but nearer to the lateral edge of the abdomen. The underside is much arched and projecting in the centre, the edges being thinner and flatter.

The sternum is short, and coalesces with a chitinous band behind the labium, to which also the epimera of the first pair of legs are joined. The epimera of the second pair are free, not joined to any other skeletal sclerites. The epimera of the two hind pairs of legs are joined together at their inner ends by a cross-piece; none of the epimera quite reach the vulval sclerites, although they approach very close. The vulva (of oviposition) (fig. 15) is large, placed far forward, its anterior end being between the coxæ of the second pair of legs; it is protected anteriorly by a thick chitinous piece of a pointed-arch shape, the point forward, and posteriorly by a more rounded and thinner piece fitting within the arch, so that the whole form a ring with an anterior point and free lateral projections. The labia extend the whole length of this ring; they bear two pairs of very minute hairs on their exterior. The anal opening is long, almost at the hind margin; it has projecting labia lying together like knife-edges, and is bordered by five pairs of spines of various sizes, of which three form a triangle on each side.

The alimentary canal (fig. 13) is of the usual type. A short œsophagus (part shown at *æ.*) leads into a large ventriculus (*v.*) wider than its length, and furnished with two large, but short, cæcal appendages (*c.*); this is sharply divided from an almost globular colon (*co*), and wide, elongated, funnel-shaped rectum (*r*). The bursa copulatrix (fig. 14, B) leads by a long, thin, flexible, hyaline, sperm-duct (*d.*) into a large yellowish sac, the receptaculum seminis (*r. s.*), which communicates by two very short but wider ducts with the paired ovaries (*o. o.*), which again lead into the long much-looped oviducts (*od. od.*), in which the eggs may be found in all stages of development.

*Male.*

The smaller size is what strikes the observer first. It will be seen by the measurements that the male is three quarters or two thirds of the length, and is about two thirds of the breadth of the female; the difference in size being almost entirely in the abdomen. With the exception of the size, there is a great resemblance between the sexes; and although there are numerous and considerable differences in detail, they are not greater than those usually found between the male and female in this genus; no one would doubt their belonging to the same species.

**Cephalothorax** similar to that of the female; but the papillæ, from which the two spines of the dorso-vertex spring, are not so large or projecting as those of the female. The sternum is longer than that of the female, but otherwise similar; a chitinous cross piece joins the inner ends of the epimera of the second, third, and fourth pairs of legs, instead of only the last two. There is a singular branched hair (fig. 12) on each side of the body, between the coxæ of the first and second pairs of legs; it is very minute, not above  $\cdot 025$  millim. long; I could not see it on the creature itself, and only discovered it from dissections of the exoskeleton.

**Legs.**—These are stouter and are longer, in proportion to the abdomen, than those of the female; the tarsal joints, however, are considerably shorter and more conical than those of the opposite sex; and the tibiæ, particularly in the two hind pairs of legs, and also the third joints of the fourth pair of legs, are very much longer in proportion. There is another singular arrangement in the two hind pairs of legs which is entirely absent in the female. These legs have a decided curve inward, and the third and fourth joints, particularly the fourth joint of the fourth leg, increase rapidly in thickness at their distal ends, the whole increase being on the inner side, so that this, at the distal end, projects, forming a large curved point, from which the tarsus curves away, forming the lower side of the point. To enable this construction to work, the articulation, although close on the outer side, is exceedingly loose on the inner side, the two joints being there attached by a flexible membrane of considerable width, generally bowed outwards, giving great play to the tarsus, probably for clasping purposes. The hairs on the legs differ very little from those of the female, but the third and fourth tarsi of the

male have a singular assemblage of small, chitinous, recurved knobs or hooks at their distal ends (fig. 11).

**Abdomen.**—This is rounded posteriorly, instead of having a straight hind margin like that of the female. It has ten projections along each side, the same number as the female, but they are larger and differently arranged, as there is greater distance between the first and second, the fact being that what would correspond to the second in the female is rudimentary in the male, the second in the male corresponding to the third in the female. On the other hand, the posterior projections extend not only along the lateral but also along the hind margin, the two tenth projections coming close together in the median line, leaving a deep narrow cut between them; this is partly due to the fact that the last spine of each dorsal longitudinal row is borne, not on the notogaster, but on a large projecting papilla on the hind margin, which forms the tenth projection of the male, and almost coalesces with the ninth projection. Bearing these differences in mind, so as not to be confused by the numerical order of the projections (*i. e.* remembering to count the rudimentary second projection), the forms of these projections, the spines they carry, the marginal bands and arching of the notogaster, and the spines upon it, correspond fairly well with the equivalent parts in the female. The copulative organs are placed in the median line between the insertions of the third and fourth pairs of legs. The anus is placed further forward than in the female, and is surrounded by a chitinous band (fig. 5); it is protected by two pairs of very large spikes near its posterior margin, the outer pair being the longer.

#### *The Nymph.*

This is easily known from its similarity to the adult, but there are, of course, numerous differences. In the fully grown nymph the sex is well marked; the bursa copulatrix and other external sexual organs of the female are easily seen; so that the male and female nymphs are somewhat different, but not so much so as the adults. Taking the fully-grown female nymph, it will be seen that it is almost white, without the pinkish shade of the adult. The legs are about the size of those of the adult, but the abdomen is considerably smaller and more square in shape; its edges are more raised and its central part more depressed than the corresponding parts of the adult. The rough projections

round the periphery, instead of being separated by spaces and absent from the hind margin, as in the adult, form an almost continuous line round the lateral and posterior margins. It is evident that the spikes carried by these projections will thus afford greater protection to the creature during growth, and at the period of life when the object of the straight hind margin of the adult has not arisen.

*The Larva.*

This has much the same characters as the nymph, except that it is smaller, more transparent and compact, with the raised edge less strongly marked, and it is, of course, hexapod.

GLYCIPHAGUS DISPAR, n. sp. (Plate XXXV. figs. 6-17.)

	Female.	Male.
Average length, about.....	·35 mm.	·17 mm.
„ breadth, about .....	·24	·13
„ length of legs, 1st pair, about.....	·16	·10
„ „ 2nd „ .....	·14	·8
„ „ 3rd „ .....	·13	·9
„ „ 4th „ .....	·19	·9

**Colour**, when just emerged white; afterwards the female is light reddish brown, darker and redder than that of *G. platygaster*. The spaces on the underside enclosed by the sclerites surrounding the genital and anal regions remain pure white. The male is dull light grey, considerably lighter than the female, and entirely without the red tinge.

**Texture** of the female very similar to that of *G. platygaster*; the male, however, is different, being covered with small hemispherical bosses or dots, much larger in proportion to the size of the creature, and much rounder and more regular.

*Female.*

Very similar, except in size, to that of *G. platygaster*, although there are numerous well-marked specific differences, particularly in the abdomen and the epimera and other chitinous pieces of the underside.

**Cephalothorax.**—Similar in almost all respects to that of *G. platygaster*, except that the hairs of the dorso-vertex do not spring from papillæ. There is not any true sternum. The vulva of parturition, which is very large, extending from the level of the insertion of the lower edge of the first leg nearly to that of the

insertion of the third leg, consists of two large, slightly chitinized labia somewhat separated posteriorly; it is entirely surrounded by a chitinous band or sclerite (Robin's sternite) at some distance from the labia laterally, but almost touching them at their lower most separated part. The chitinous ring is thickest at the sides and thinnest posteriorly. Chitinous epimera, or bands, start from above the first leg, below the second leg, and between these two legs, and all run radially inward, joining the vulval sclerite above described. The epimeron in front of the third leg is a short curved piece, often almost obsolete, running forward, and nearly, but not quite, touching the epimeron from below the second leg about its middle. The epimeron behind the third leg is a somewhat similar, but more strongly marked, piece pointing toward the lower part of the vulval sclerite, but not nearly reaching it. There is scarcely any epimeron to the fourth leg.

**Legs** very similar in all respects to those of *G. platygaster*, but rather thicker in proportion. The hairs are practically similarly placed.

**Abdomen** resembling that of the female of *G. platygaster* in general form, but not quite so wide in proportion to its length, and the *hind margin is totally different*, for, instead of being straight, it is entirely occupied by two great rounded lobes directed backward; the projecting "anal button" (bursa copulatrix) is sunk in the indentation between the two lobes. There are nine projections on each side, instead of ten as in *G. platygaster*. These are usually all more or less bifid or trifid; they are irregular in form, each one, except the second and sixth, serving as the point of insertion of a very strong pointed spine, thick at the base and gradually narrowing. The first of these spines points forward, the others, instead of being nearly radial as in the last species, are strongly curved, often having a tendency to a double curve, and are directed first outward and then backward, so that the distal portion is nearly parallel to the side of the abdomen. *There are not any spines on the notogaster except two so close together that they generally look like a single large one* in the median line a little behind the centre, and a pair of much smaller spines further forward. The anal opening is large, placed rather far forward, and entirely surrounded by an elliptical chitinous ring, within which the whole anal region is white. There are two pairs of spines of moderate size near the hinder part of this ring,

and a pair of larger spines on the underide of the abdomen, further back and more to the side.

*Male.*

This is quite unlike the female in appearance; irrespective of the extreme difference in size, and the difference in colour and texture before referred to, the legs and abdomen are quite dissimilar.

**Cephalothorax** much like that of the female, but without the hinder of the two pairs of spines conspicuous in that sex, and having the front pair very small and exactly at the angle of the epistome. The trophi, particularly the palpi, seem to be well formed. There is not any true sternum nor any epimera to the second, third, or fourth legs; but there is an epimeral piece both above and below the first leg, which two are joined at their inner ends, and the lower is also joined to the outer penial sclerites (Pl. XXXV. fig. 17).

**Legs** short and thick, almost conical, but slightly curved. The two hinder pairs are wholly hidden beneath the body. The femora are somewhat bell-shaped, particularly in the two posterior pairs of legs (the two front pairs having an inward curve). The tarsi of the two hind pairs of legs are articulated in the same manner as those of the male of *G. platygaster*; but the arrangement is not quite so conspicuous. The caruncles are proportionally shorter and broader than those of the female.

**Abdomen** almost shield or spade-shaped, the anterior margin straight for the short distance where it joins the cephalothorax, then running outward and backward in a double curve on each side. The abdomen is widest at the anterior angle of the lateral margin, and gradually narrows backward. The hind margin is rounded. There is a low broad rounded elevation along the greater part of the median line, with a sulcation round it; otherwise the notogaster is flat. The abdomen is less thick in proportion, from dorsal to ventral surface, than that of the female. Round the edge are six or seven very small straight spines; the bifid or trifid projections and great curved spines of the female are entirely absent. There are three or four pairs of small spines on the notogaster similar to those round the edge. The anus is also protected by two pairs of spines.

## DESCRIPTION OF THE PLATES.

## PLATE XXXIV.

*Glyciphagus platygaster.*

- Fig. 1. Adult female, dorsal view.  $\times 65$ .  
 2. Adult male, dorsal view.  $\times 65$ .  
 3. Larva, dorsal view.  
 4. Adult female, ventral surface.  $\times 50$ .  
 5. Adult male, ventrol surface.  $\times 56$ .  
 6. Half of the labial organs of the adult female, from below,  $\times 300$ .  
*p*, palpus; *mx*, maxilla; *la*, labium; *li*, lingua. The skeletal strengthening of the labium and supporting organs are seen through the integument.  
 7. Mandible of adult male, seen from the side.  $\times 300$ .  
 8. Fourth right leg of adult female, side view.  $\times 150$ .  
 9. Fourth left leg of adult male, side view.  $\times 150$ .  
 10. End of the tarsus of the fourth leg of the adult female, from above.  $\times 450$ .  
 11. End of the tarsus of the fourth leg of the adult male, from the side, to show the projections.  $\times 400$ .  
 12. Branched hair from the side of the body of the male, placed between the coxæ of the first and second pair of legs.  $\times 600$ .  
 13. Alimentary canal,  $\times 85$ ; *a*, part of the œsophagus; *v*, ventriculus; *c*, cæca thereof; *co*, colon; *r*, rectum.  
 14. Part of the female reproductive system,  $\times 85$ . *B*, external opening of the bursa copulatrix, which is drawn as advancing straight towards the eye, and attached to a portion of the surrounding integument; *d*, sperm-duct; *rs*, receptaculum seminis; *o*, *o*, ovaries; *od*, *od*, portions of the oviducts.  
 15. The vulva of oviposition, seen from within, showing on the left the muscles (retractores labii), and on the right the (so-called) suckers.

## PLATE XXXV.

*Glyciphagus platygaster*, figs. 1-5.*Glyciphagus dispar*, figs. 6-17.

- Fig. 1. *Glyciphagus platygaster*. Adult female, first left leg, from above.  $\times 150$ .  
 2. ———. Adult male, third left leg, from the outer side.  $\times 150$ .  
 3. ———. Adult female, mandible, from below.  $\times 150$ .  
 4. ———. Adult female, left palpus, from below.  $\times 400$ .  
 5. ———. Nymph.  
 6. *Glyciphagus dispar*. Adult female.  $\times 130$ .  
 7. ———. Adult male.  $\times 200$ .  
 8. ———. Underside of adult female, showing male *in coitu*. Both drawn to the same scale, viz.  $\times 130$ .  
 9. ———. Adult female, mandible.  $\times 400$ .

- Fig. 10. *Glyciphagus dispar*. Adult female, first left leg, from above.  $\times 300$ .  
 11. ———. Adult female, second left leg, from above.  $\times 300$ .  
 12. ———. Adult female, third left leg, from above.  $\times 300$ .  
 13. ———. Adult female, fourth left leg, from above.  $\times 300$ .  
 14. ———. Adult male, first left leg, from above.  $\times 400$ .  
 15. ———. Adult male, third left leg, from above.  $\times 400$ .  
 16. ———. Adult male, fourth left leg, from above.  $\times 400$ .  
 17. ———. Adult male, arrangement of the intromittent organ and surrounding sclerites, &c.
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Description of *Strongylus Arnfieldi* (Cobb.), with Observations on *Strongylus tetracanthus* (Mehl.). By T. SPENCER COBBOLD, M.D., F.R.S., F.L.S., Hon. Vice-Pres. Birmingham Nat. Hist. and Microsc. Society.

[Read 4th March, 1886.]

(PLATE XXXVI.)

It has been commonly taken for granted that all the Nematodes hitherto found to infest the lungs of Solipeds are referable to the species which proves so destructive to young cattle. On the authority of Eichler in the one case and of Gurlt in the other, Diesing states that the cattle Strongyle (*Strongylus micrurus*) infests *Equus caballus* and *E. asinus*. As regards the horse I have verified Eichler's find, but as regards the ass it happens that all the lung-worms carefully examined by me are of a different species. This circumstance does not, of course, disprove the accuracy of Gurlt's position, but rather renders it probable that at least two nematode-species infest the lungs of both hosts.

On the 1st of December, 1882, Mr. Arnfield, at that time a pupil of the Royal Veterinary College, brought me some worms removed from the trachea and bronchi of a donkey. The batch comprised three males and ten females, most of the latter being much injured. Guided by their size and general aspect it was easy enough to suppose that the worms were examples of *Strongylus micrurus*; but a microscopic examination showed that the naked-eye appearances were deceptive. The worm, in fact, was new to science, and it was accordingly named after its discoverer. To secure priority in the finder's favour a brief description followed in the pages of 'The Veterinarian' (Jan. 1884), but no figure of the worm has hitherto been published. Subsequent to





